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TITLE: Surveillance camera system

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US-CL-CURRENT: 396/427; 348/143

## CLAIMS:

What is claimed is:

1. In a surveillance camera system, a camera module for monitoring a selected area comprising:

- (a) a housing;
- (b) a pan motor platform fixedly mounted to said housing;
- (c) a pan motor fixedly mounted to said pan motor platform;
- (d) a tilt motor platform rotatably mounted to said pan motor platform to permit rotation of said tilt motor platform about a pan axis;
- (e) a first mechanical coupling between said pan motor and said tilt motor platform for effecting rotation of said tilt motor platform about the pan axis during operation of said pan motor;
- (f) a tilt motor fixedly mounted to said tilt motor platform;
- (g) a camera rotatably mounted to said tilt motor platform to permit rotation of said camera about a tilt axis;
- (h) a second mechanical coupling between said tilt motor and said camera to effect rotation of said camera about the tilt axis during operation of said tilt motor;
- (i) a slip ring mounted on said pan motor platform for providing electrical connections to said tilt motor and said camera; and
- (j) an auto-pivot means for automatically effecting rotation of said tilt motor platform about the pan axis by operating said pan motor so that said camera pans 180 degrees.

2. The apparatus as recited in claim 1, wherein said auto-pivot means comprises a local controller mounted on said pan motor platform, the local controller including means for monitoring a tilt speed and means for monitoring a tilt position of said camera, the local controller being operable to compare a tilt speed setting to a reference tilt speed and to energize said pan motor to rotate said tilt motor platform 180.degree. about the pan axis when (a) the tilt speed setting is at least equal in magnitude to the reference tilt speed and (b) said camera is substantially in its vertical position.

3. The apparatus as recited in claim 1, wherein said camera comprises an adjustable zoom lens having a plurality of zoom settings; said camera module further comprising a local controller mounted on said pan motor platform, the local controller including means for recording a zoom setting of the zoom lens; and

speed scaling means for automatically adjusting the speed of said pan motor based on the recorded zoom setting.

4. The apparatus as recited in claim 1, further comprising:

a data storage device for receiving and storing a plurality of combinations of pan and tilt positions;

retrieving means for retrieving the combinations of pan and tilt positions in a desired sequence; and

play back means for automatically positioning the camera in accordance with a retrieved sequence of combinations of pan and tilt positions.

5. The apparatus as recited in claim 1, further comprising:

a pan motor controller including first programmable means for setting a desired current level for said pan motor in proportion to a speed of said pan motor during operation thereof, wherein the desired current level for said pan motor corresponds to one of the following selected from the group consisting of idling, steady traveling, acceleration, and deceleration of said pan motor.

6. The apparatus as recited in claim 5, further comprising:

a tilt motor controller including second programmable means for setting a desired current level for said tilt motor in proportion to a speed of said tilt motor during operation thereof, wherein the desired current level for said tilt motor corresponds to one of the following selected from the group consisting of idling, steady traveling, acceleration, and deceleration of said tilt motor.

7. The apparatus as recited in claim 1, wherein said housing is adapted for mounting in a ceiling and comprises:

a base mountable over an opening in the ceiling and having an upwardly extending inner surface;

an inner frame disposed within the base for supporting said pan motor platform, the inner frame being formed for movement within the base along the upwardly extending inner surface; and

fastening means for restricting a vertical movement of the inner frame relative to the base along the upwardly extending inner surface, whereby the inner frame can be vertically adjusted and fixedly positioned relative to the base to accommodate ceilings of different thicknesses.

8. In a surveillance camera system, a camera module for monitoring a selected area comprising:

(a) a housing;

(b) a pan motor platform fixedly mounted to said housing;

(c) a pan motor fixedly mounted to said pan motor platform;

(d) a tilt motor platform rotatably mounted to said pan motor platform to permit rotation of said tilt motor platform about a pan axis;

(e) a first mechanical coupling between said pan motor and said tilt motor platform for effecting rotation of said tilt motor platform about the pan axis during operation of said pan motor;

(f) tilt motor fixedly mounted to said tilt motor platform;

(g) a camera rotatably mounted to said tilt motor platform to permit rotation of said camera about a tilt axis;

(h) a second mechanical coupling between said tilt motor and said camera to effect rotation of said camera about the tilt axis during operation of said tilt motor; and

(i) a slip ring mounted on said pan motor platform for providing electrical connections to said tilt motor and said camera, wherein said housing is adapted for mounting in a ceiling and comprises:

a base mountable over an opening in the ceiling and having an upwardly extending inner surface;

an inner frame disposed within the base for supporting said pan motor platform, the inner frame being formed for movement within the base along the upwardly extending inner surface; and

fastening means for restricting a vertical movement of the inner frame relative to the base along the upwardly extending inner surface, whereby the inner frame can be vertically adjusted and fixedly positioned relative to the base to accommodate ceilings of different thicknesses.

9. A method for monitoring a selected area using a surveillance camera system, the system including a camera module and a monitoring station, the camera module including a camera and a pan-and-tilt mechanism having a tilt motor for tilting the camera and a pan motor for panning the camera, said method comprising the steps of:

(a) operating a tilt motor at a selected tilting speed to effect tilting of the camera such that the camera moves from a generally horizontal position to a generally vertical position;

(b) monitoring a tilt position and the tilting speed of the camera;

(c) comparing the tilting speed to a reference tilting speed; and  
(d) automatically pivoting the camera by operating the pan motor so that the camera pans 180 degrees when the camera is substantially in its vertical position and the tilting speed is at least equal to the magnitude of the reference tilting speed.

10. The method as recited in claim 9, further comprising the step of: operating the tilt motor so that the camera tilts from the generally vertical position to the generally horizontal position after said step of automatically pivoting the camera.

11. The method as recited in claim 9, further comprising the step of: automatically stopping the tilting of the camera when the camera is substantially in the vertical position and the tilting speed is less than the reference tilting speed.

12. A method of monitoring a selected area using a surveillance camera system, the system including a camera module and a monitoring station, the camera module including a camera, a focusable lens affixed to the camera, and a pan-and-tilt mechanism having a pan motor for panning the camera, said method comprising the steps of:

(a) operating the pan motor at a selected pan speed to effect panning of the camera to view a moving target;

(b) periodically reading a parameter that relates to the distance between the camera and the moving target, the parameter varying as the distance between the camera and the moving target varies; and then

(c) periodically adjusting the pan speed in response to the parameter, whereby the pan speed is automatically adjusted based on the distance between the camera and the moving target.